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A new palliative and pain educational model for pediatric residents

Franca Benini[1*], Lucia De Zen[2], Sergio Amarri[3], Elisabetta Bignamini[4], Marco Bolognani[5], Igor Catalano[6], Momcilo Jankovic[7], Luca Manfredini[8], Michele Salata[9], Anna Zanin[1], Antonio Corsello[10], Egidio Barbi[11,12], Gian Luigi Marseglia[13,14] and Eugenio Baraldi[15]

Abstract

Background In Europe, resident doctors are not provided with standardized educational modules on pain management (PM) and pediatric palliative care (PPC).

Methods Italian Schools of Residency in Pediatrics (ISRP) were invited to participate in an education project on PM and PPC. A questionnaire was distributed before the start of the teaching module (May 2023) to assess the state of the art in PPC and PM educational programs among the ISRP. Between June and December 2023, three synchronous and twelve asynchronous online modules were delivered. This project was carried out nationwide. Data were collected using pre- and post-module questionnaires administered through a dedicated online learning platform, ensuring uniformity and reliability of responses. The information gathered included the participants' universities, years of residency, pre- and post-course test results, and satisfaction with the course content.

Results All ISRP participated, enrolling 2671 residents (70.3% of Italian pediatric residents). A total of 52.7% completed the program, with all passing the final competency test (ECTS—credits). Pre- and post-module assessments demonstrated a significant improvement in theoretical knowledge, with the percentage of correct answers rising from 22.5% to 90.4%. Overall satisfaction was high (4/5 on a Likert scale).

Conclusions This remote teaching module effectively enhanced residents'knowledge and skills in PM and PPC. Although it was effective in terms of education and satisfaction, it could further benefit from structured complementary training offered within the regional clinical network.

Keywords Pediatric palliative care, Pain management, Medical education, Residency training, Public health

Background

According to current medical standards, every child and adolescent with a life-limiting (LLC) or life-threatening condition (LTC) should be able to receive pediatric palliative care (PPC) to alleviate pain and improve their quality of life [1–3]. Worldwide, approximately 22 million minors are estimated to require PPC, and their number has grown steadily over the last 20 years [1]. Although the availability of services and skills is also increasing [3–6], in Italy, only 25% of children in need of PPC in Italy receive care in specialized centers [2, 7].

To effectively deploy PPC in any workplace, it is critical to understand what it is and how to overcome barriers and misconceptions about it. The early identification of individuals requiring PPC has been deemed essential to improve the knowledge among healthcare professionals. The need for learning in this area is internationally recognized. Since 2006, many institutions worldwide have conducted surveys aimed at characterizing the educational needs perceived by pediatric residents (PR), mostly resulting in a perception of insufficient preparation in all

*Correspondence:
Franca Benini
franca.benini@aopd.veneto.it
Full list of author information is available at the end of the article

areas covering PPC; these works and assessments served as a basis for planning specific educational interventions [8–14]. In 2023 the American Academy of Pediatrics has proposed a curriculum framework to integrate PPC into residency training, emphasizing the importance of structured education in this field [15]. Moreover, some institutions have started dedicating a specific pediatric track in their postgraduate education programs, to educate young specialists on the unique needs of children requiring palliative care [16, 17].

In recent years, increasing attention has been given to PPC education for residents in Europe to provide healthcare professionals with the necessary skills and knowledge to deliver holistic and effective care to children with LLC and LTC and their families. Guidelines and resources for teaching PPC to healthcare professionals are available from the European Association for Palliative Care [18]. In Italy, the standard curriculum for PR is divided into three years of general pediatrics and two years of subspecialties, with the option of pursuing PPC and pain management (PM). To provide equal patient access, all trainers get the same basic training [19]. The new curriculum of the Italian Schools of Residency in Pediatrics (ISRP) recognizes the relevance of PPC and has established a program that, beginning in 2023, will require medical doctors to gain learning credits in this discipline while studying.

The new educational model was developed in collaboration with national experts in PPC and features an integrated approach combining synchronous and asynchronous modules. This training pathway, aimed at addressing the gap in standardized education, integrates theoretical knowledge with practical applications in line with the latest international guidelines. Our goal was to develop a new specialized educational program for all Italian PR to improve their understanding and awareness of PM and PPC.

Methods

The online learning module

The Pediatric School of Residency at the University of Padua proposed to the Board of Directors of the ISRP a distance learning project open to all of their residents in order to make PM and PPC learning as homogeneous and capillary as possible. As a result, the University of Padua Center established and coordinates a steering committee (SC) consisting of Italian experts in the field. The group included pediatric pain and palliative care professionals, hospice directors, pediatric facility managers, and education and learning experts. This study group was supported by the Board of Directors of the ISRP and the Italian National Association of Pediatric Residents ("Osservatorio Nazionale Specializzandi in Pediatria", ONSP).

The main learning goals that guided the creation of the course were the acquisition of basic knowledge and tools to address and manage pain and complexity in life-limiting/threatening pediatric diseases, as well as of resources to refer to and interact with each regional PM and PPC network in situations of greater complexity. The specific clinical topics on which the learning program was based are reported in Table 1. The SC prepared a distance learning program consisting of 12 asynchronous and three synchronous webinars.

The 12 asynchronous modules (six on pain and six on PPC approach), each lasting approximately 20 min, were made available for free on a dedicated platform from June 15 th to December 31 st, 2023. Each module followed a systematic format: it started with a clinical case, followed by interactive questions, theoretical explanations, and final conclusions, returning to the initial case with

Table 1 Structure and topics of the learning module

Asynchronous online module	
PAIN MODULE	PEDIATRIC PALLIATIVE CARE MODULE
Pain in newborns, children, adolescents: why worry about it?	PPC definition and PPC organizational model
Anatomy and pathophysiology of pain	Eligibility criteria and epidemiology of needs
Diagnosis—evaluation measurement	The clinical care complexity: analysis of global needs
Red flags	Management of symptoms in PPC
Pharmacological therapy	Communication and ethical and legal aspects
Non-pharmacological therapy	End-of-life and bereavement management
Synchronous online module	
Delivering Bad News	
Bioethics and Biolaw	
Complex pain in pediatric settings	

correct answers and explanations. Progression to the next module required a minimum score of 75% on a questionnaire regarding the themes presented in the lesson.

The synchronous online modules consisted in three 90-min webinars, during which three speakers discussed particularly relevant clinical topics starting from real-life situations or patient cases. The online module was implemented using a dedicated educational platform, an interactive and secure solution that enabled real-time monitoring of participants' progress. Each module was structured in four phases: presentation of a clinical case, interactive questions, theoretical explanations, and a final assessment, ensuring a comprehensive and progressive learning experience.

Participants' demographics

The course was promoted and advertised by all the ISRP and through the ONSP. Participants accessed the learning program via a personal link.

Demographic data included: university, year of residency and number of residents for each school divided by year. To conduct comparative analyses (primarily related to the extent of the project participation), the total number of residents enrolled in ISRP in the 2022–2023 academic year was evaluated. The data were collected by analyzing the documentation on the University and Research Ministry (MUR) website for the academic years from 2017 to 2022.

Questionnaires

Pre- and post-learning surveys evaluated participants' competencies before and after each module. To get a certificate of attendance and ECTS credits, participants had to complete the pre-test and pass the post-module tests, achieving at least 75% right responses on multiple-choice questions.

In addition, a survey was done using a Likert scale ranging from 0 to 5 (0 = very bad/inadequate, 5 = excellent), with questions about overall course satisfaction, teacher evaluation, and participants'confidence levels before and after the course. Lastly, each school director was handed a questionnaire (see Annex 1) to assess the sort of PM and PPC education provided to their residents prior to the introduction of this new module.

Analysis

To evaluate and understand the reasons for abandonment, an email (see Annex 2) was sent to the attendees who did not complete the course. The email contained a single question aimed at clarifying the reason for their discontinuation. A reminder was sent after two weeks. Categorical data were analyzed primarily by t-tests. Data are expressed as total counts, percentages, and means. Data were analyzed using SPSS Statistics version 27 (IBM Corp., Armonk, NY, USA). In addition to using t-tests for comparing means, frequencies, percentages, and averages were calculated to ensure an accurate evaluation of the results.

Results

In the 2022–2023 academic year, 3796 residents were enrolled in pediatric programs according to MUR data.

Table 2 summarizes the distribution of all residents by site and year of residency. The two "Roma La Sapienza University" schools were combined, resulting in a total of 36 schools. All ISRP joined the program with varying degrees of attendance.

Asynchronous online module

The total number of residents participating in the online educational module was 2671/3796 (70.34%). Complete data was collected from 2576 participants (67.8%). All the results are summarized in Table 3. The distribution of attendance per year of residency is shown in Table 4.

The entire educational module was completed by 2002 residents (53% of all Italian residents and 75% of all learning program participants). They all passed the competence test and got ECTS credits, with 44% in the first and second years of residency, 55% in the third, 47% in the fourth, and 67% in the fifth (Fig. 1).

Furthermore, data were to see if an association between medical trainees'participation in the PPC training module and the establishment of a PPC Reference Center in their region could be observed. The percentages of involvement did not change substantially between groups (Fig. 2).

Participants dropout

Among 2576 participants, 578 (22%) did not complete the learning module. Only 73 residents (13%) responded to the mail regarding the reasons for their dropout, indicating mostly organizational and/or personal problems (96%).

Pre- and post-module assessment – Residents

The percentages of correct answers in the baseline and final assessments were 22.5% and 90.4%, respectively. As described in the Table 5, in the post-test, a lower percentage of correct answers referred to PPC definition and PPC organizational model (87.11%, 649 test failed), eligibility criteria for PPC and epidemiology of needs (88.6%, with 1114 test failed), symptom management in PPC (88.87%, with 1310 test failed) and diagnosis—evaluation—measurement of pain (91.87%, with 461 test failed), statistically different from the other modules ($p = 0.04$), indicating a higher need of education on these themes.

Table 2 The distribution of all residents accordingly to the site and the year of residency in the academic year 2022–2023 (data collected from MUR website)

University site	Year of residency					Total
	V	IV	III	II	I	
BARI	12	17	21	25	23	**98**
BOLOGNA	23	25	34	45	36	**163**
BRESCIA	10	15	18	27	23	**93**
CAGLIARI	10	15	20	22	22	**89**
CAMPANIA L. VANVITELLI	19	24	31	39	35	**148**
CATANIA	9	14	18	15	15	**71**
CATANZARO	5	0	5	10	9	**29**
ROMA CATTOLICA SACRO CUORE	11	22	26	24	20	**103**
CHIETI-PESCARA	9	13	16	16	12	**66**
FERRARA	13	16	23	24	19	**95**
FIRENZE	20	30	30	36	31	**147**
FOGGIA	8	0	7	10	13	**38**
GENOVA	20	26	34	34	29	**143**
VARESE—INSUBRIA	1	0	5	10	9	**25**
MESSINA	11	14	19	17	19	**80**
MILANO	27	34	41	50	44	**196**
MILANO BICOCCA	9	12	17	26	22	**86**
MODENA-REGGIO EMILIA	19	13	16	17	16	**81**
NAPOLI FEDERICO II	22	30	38	47	43	**180**
PADOVA	32	40	42	49	42	**205**
PALERMO	15	25	32	45	34	**151**
PARMA	16	18	22	30	26	**112**
PAVIA	14	19	24	31	27	**115**
PERUGIA	6	8	17	21	12	**64**
NOVARA-PIEMONTE ORIENTALE	9	13	15	20	18	**75**
PISA	12	13	20	20	14	**79**
POLITECNICA DELLE MARCHE	7	13	19	21	23	**83**
ROMA LA SAPIENZA (FM/MO)	30	37	47	46	39	**199**
ROMA LA SAPIENZA (FMP)						
ROMA TOR VERGATA	13	21	23	23	18	**98**
MILANO S. RAFFAELE	6	11	13	15	13	**58**
SALERNO	4	8	12	13	13	**50**
SIENA	12	16	24	25	22	**99**
TORINO	23	32	41	44	40	**180**
TRIESTE	8	16	21	19	16	**80**
UDINE	6	11	14	12	10	**53**
VERONA	24	28	33	45	34	**164**
Total	**495**	**649**	**838**	**973**	**841**	**3796**

Synchronous online module

On September 11 st and 25 th and October 9th, 2023, three online synchronous modules were offered to the residents dedicated to "Delivering bad news", "Bioethics and Biolaw" and "Complex pain in pediatric settings". The attendance was 1732, 706 and 594 residents, respectively.

Teaching assessment on PM and PPC – School Directors

After distributing the questionnaire twice, 26 school directors responded (70.2%). Figure 3 depicts the distribution of time in hours spent to PPC (A) and PM (B) during the course of the pediatric specialty school prior to the availability of this online module.

Table 3 Number of residents who participated in the online educational module distributed by University site and year of residency (the % refers to the number of residents enrolled/total of each University)

University site	Year of residency					Total
	V	IV	III	II	I	
BARI	11	7	31	3	16	**68 (70%)**
BOLOGNA	28	17	30	10	14	**99 (61%)**
BRESCIA	11	13	13	21	21	**79 (85%)**
CAGLIARI	10	15	20	22	22	**89 (100%)**
CAMPANIA L. VANVITELLI	22	23	30	33	24	**132 (90%)**
CATANIA	0	2	2	1	2	**7 (10%)**
CATANZARO	4	0	6	8	5	**23 (80%)**
ROMA CATTOLICA DEL SACRO CUORE	7	18	24	21	10	**80 (78%)**
CHIETI-PESCARA	7	4	1	0	3	**15 (23%)**
FERRARA	11	12	20	22	16	**81 (85%)**
FIRENZE	29	2	14	1	3	**49 (33%)**
FOGGIA	6	0	6	8	10	**30 (79%)**
GENOVA	13	25	31	28	28	**125 (87%)**
VARESE—INSUBRIA	0	0	4	10	9	**23 (92%)**
MESSINA	18	14	9	11	6	**58 (72%)**
MILANO STATALE	21	28	28	24	15	**117 (60%)**
MILANO MODENA	11	12	14	25	19	**81 (94%)**
MODENA-REGGIO EMILIA	19	11	14	20	5	**69 (85%)**
NAPOLI FEDERICO II	22	28	30	44	36	**160 (89%)**
PADOVA	21	28	38	43	36	**167 (81%)**
PALERMO	15	23	26	19	10	**91 (60%)**
PARMA	12	17	20	29	24	**102 (91%)**
PAVIA	16	15	19	26	27	**103 (90%)**
PERUGIA	4	3	13	11	13	**44 (69%)**
NOVARA—PIEMONTE ORIENTALE	5	13	13	7	11	**49 (65%)**
PISA	11	8	20	22	5	**66 (83%)**
POLITECNICA DELLE MARCHE	3	11	8	18	18	**58 (70%)**
ROMA LA SAPIENZA (FM/MO)	24	31	35	45	37	**172 (87%)**
ROMA LA SAPIENZA (FMP)						
ROMA TOR VERGATA	26	2	2	3	1	**34 (35%)**
MILANO S. RAFFAELE	6	0	0	0	0	**6 (10%)**
SALERNO	2	7	16	8	15	**48 (96%)**
SIENA	12	9	6	5	8	**40 (40%)**
TORINO	6	18	2	5	1	**32 (18%)**
TRIESTE	9	12	17	13	14	**65 (81%)**
UDINE	4	9	8	8	12	**41 (77%)**
VERONA	22	8	13	9	21	**73 (44%)**
Total	**448**	**445**	**583**	**583**	**517**	**2576 (67,8%)**

PPC physicians supplied specific training at 10 of 17 schools (62%), with anesthesiologists, pediatric oncologists, or pediatric intensivists providing the rest. Anesthesiologists offered PM training in around half of the universities.

Among the 26 schools that provided data, 15 (57%) did not organize mandatory seminars on PPC, and 18 (69%) did so on PM. Ten (38%) schools provided internships during the residency program at facilities/centers/services that provide PM and PPC.

According to the 26 school directors, the importance of teaching PPC and PM in the pediatric curriculum was rated, on a 0–10 scale (0 = no importance, 10

Table 4 Number of residents who participated in the asynchronous e-learning, broken down by year of school

Year of residency	N° registered in the residency program	N° attending the e-learning module	%
I	841	517	**68**
II	973	583	**60**
III	838	583	**70**
IV	649	445	**68**
V	495	448	**90**
Total	**3796**	**2576**	**68%**

= maximum importance), as very important (average PM: 8.7, PPC: 8.5).

Overall satisfaction

The overall satisfaction reached a mean value of 4/5, on a Likert scale (range 0–5). Relevance of the topics covered was also very good (median = 4.36), as the quality of the proposed learning model (median = 4.24) and usefulness of what was proposed in the learning process (median = 4.2). Most of the attendees judged that the time dedicated to the educational program was adequate

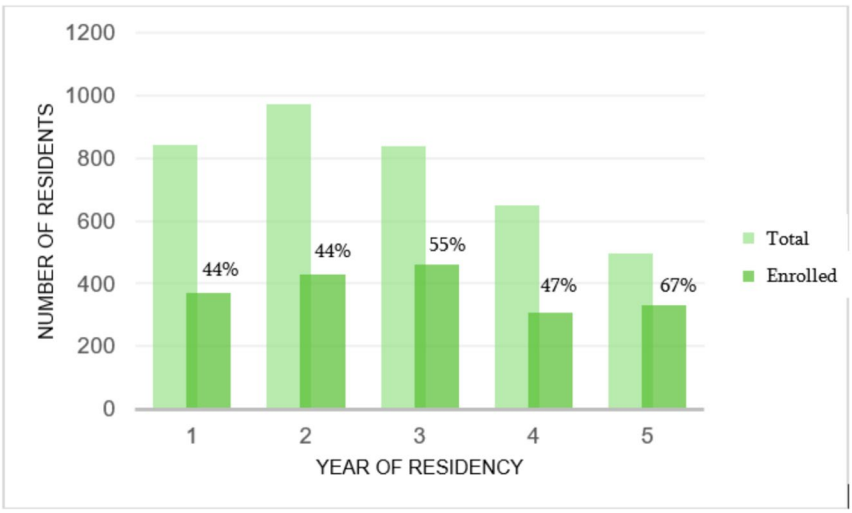

Fig. 1 Distribution of the percentage of residents who completed the educational module divided by year of residency

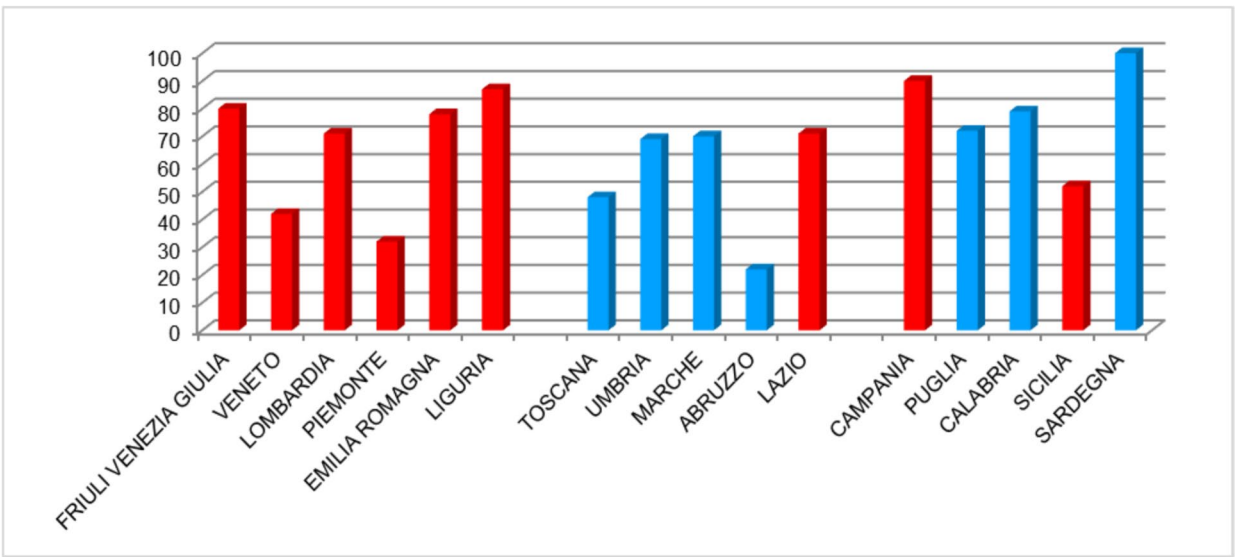

Fig. 2 Percentage of trainees who participated in the asynchronous distance learning, grouped by Region to which the School belongs. The red bars indicate the presence of a Centre/Regional Network/Hospice

Table 5 Analysis of post-test answers

Topics	N° test passed	N° attempts	% correct MCQ	N° test failed
Pain in newborns, children, adolescents: why worry about it?	2127	2178	96,58	0
Anatomy and pathophysiology of pain	2099	2233	93,78	1
Diagnosis—evaluation—measurement of pain	2088	2549	91,87	1
Red flags	2075	2123	94,76	0
Pharmacological therapy	2063	3860	100	2
Non Pharmacological therapy	2045	2162	92,82	0
Eligibility criteria for PPC and epidemiology of needs	2039	3153	88,6	0
Clinical care complexity: analysis of global needs	2023	2072	96,82	0
PPC definition and PPC organizational model	2028	2677	87,11	4
Symptoms management in PPC	2023	3333	88,87	0
Communication and ethical and legal aspects	2014	2025	97,84	0
End of life and bereavement management	2003	2281	100	0

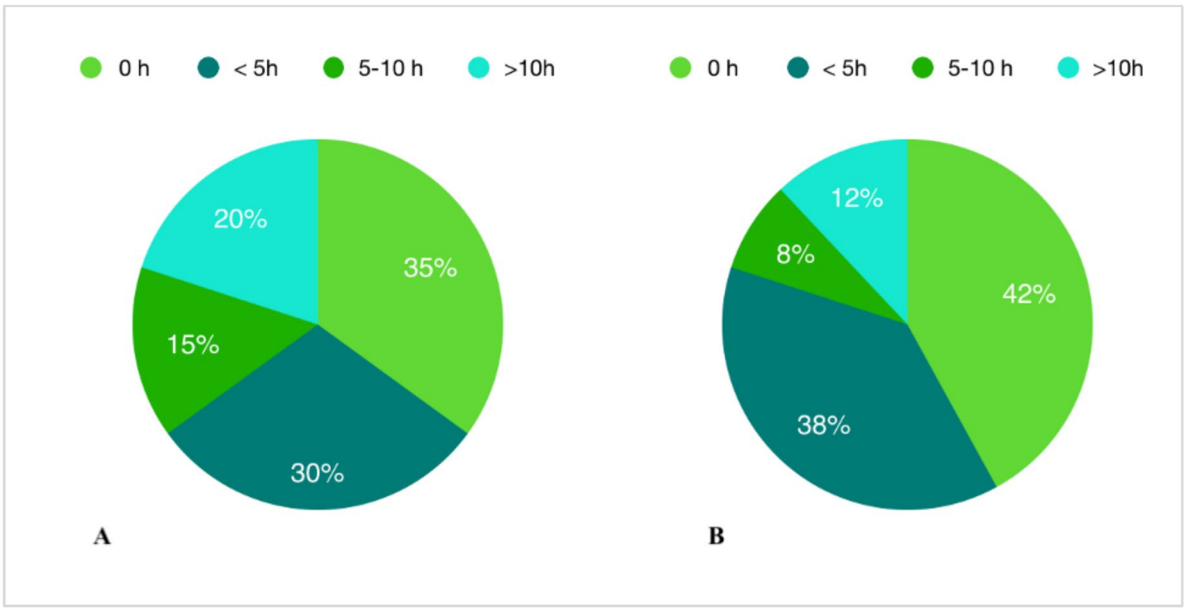

Fig. 3 Hours (h) dedicated to teaching PPC (**A**) and PM (**B**) during the school of residency in pediatrics, before the start of this educational program

(median =4.06), but in the open-ended question, the need for additional modules with immediate practical impact and clerkships emerged, especially for residents in regions where a regional reference center has not yet been activated.

Discussion

Proficiency in PM and PPC is a critical clinical competency that every pediatric resident should acquire, regardless of their eventual subspecialty. Despite the acknowledged importance of PM skills and increasing number of patients with complex chronic medical conditions requiring PPC, training in this area remains insufficient for Italian trainees in providing such care [9]. Our work represents the first national educational program with a consistent list of topics developed by a multidisciplinary study group focusing on PM and PPC. This project reached a large audience, including 70% Italian residents and all ISRP.

Since 2010, Italy's legislative framework has acknowledged the importance of a coordinated PPC network, requiring regional referral centers to help patients and their families throughout care settings such as homes, hospitals, and hospices [7, 20]. According to this model,

a specialized and multidisciplinary team assigned to the referral center is in charge of coordinating and supporting the entire network's care activities around the clock, while also supervising children and their families in all care settings. According to recent surveys, roughly 20,540 to 32,864 children in Italy require PPC, which equates to 34 to 54 children per 100,000 inhabitants. Among these, 18 out of 100,000 require a specialized PPC solution, which is described as a dedicated setting staffed by an interdisciplinary team of PPC experts [2, 21].

Despite the existence of laws that support and underlines the need for global care, the large number of children who are eligible for PPC but do not receive it indicates a gap in PPC implementation in Italy [7]. As a result, it is critical to promote the PPC culture, which includes understanding its definition and purpose, eligibility criteria, care model, and network-based working technique. All these elements are particularly important for pediatric residency background.

Paulsen et al. emphasized the importance of integrating PPC education into medical residencies to address the growing need for palliative care services [17]. Their findings underscore that a structured curriculum not only enhances knowledge but also prepares residents to incorporate palliative care principles into routine practice. Similarly, Gula et al. proposed a curricular framework that integrates PPC education into residency programs through a combination of didactics, simulation-based learning, and reflective practice [15]. The proposed model aligns with these recommendations, as it introduces essential PPC competencies using a scalable online platform to reach pediatric residents in Italy.

The success of this program lies on its structure and multimodal approach, which mirrors successful curricula implemented internationally. For example, Romanos-Sirakis et al. highlighted the benefits of a multimodal curriculum, combining lectures, case discussions, and simulations, to improve residents' knowledge and skills in PPC [22].

Similarly, Barnett et al. reported significant improvements in residents' education through innovative tools such as"Pain Cards,"which enhanced understanding of pain assessment and management [23]. Yazdani et al. also demonstrated that longitudinal, case-based methods effectively increased interns'comfort levels in managing PPC cases over time [24]. Our national program adopted comparable strategies, including case-based asynchronous modules and synchronous webinars, ensuring standardized learning across all ISRP.

According to the school directors survey, 35% of pediatric education programs do not provide any PPC learning, and 42% do not provide pain learning to residents. Additionally, only 20% and 11% of the ISRP include modules of more than 10 h each.

Importantly, school directors stressed the importance of PPC and PM education, giving them ratings of 8.5 and 8.7 out of ten, respectively. However, approximately 70% of schools continue to lack mandatory PM seminars, and 57% (15 schools) do not offer formal PPC training. These findings are consistent with prior assessments, in which pediatric residents reported inadequate PPC training despite recognizing its importance [23, 24]. Addressing this disparity requires incorporating PPC and PM as essential components of pediatric curriculum, which is recommended by worldwide guidelines.

Despite the recognition of these competencies as "core competencies" (8.7/10 for pain and 8.5/10 for PPC), only 15 (57%) schools organized seminars on PPC, and 18 (69%) organized seminars on pediatric PM. In many Italian regions, the organization and structuring of the PPC network is still ongoing due to the novelty of the situation and the heterogeneity of internal local structures and jurisdictions. Few centers can provide specialized learning on these topics during residency; to date, only ten schools (38%) have offered internship periods during residency. One explanation is that this subspecialty in pediatrics is relatively young in terms of organization and recognition in comparison to other specialties, as well as its transversal and multidisciplinary nature, which is shared with anesthesiologists and other healthcare professionals. These findings are consistent with the work of Lefeubvre et al., who identified gaps in knowledge and practical exposure among French pediatric residents [12]. Their national survey revealed insufficient formal training opportunities, a lack of structured curricula, and variability in PPC education.

From a resident's perspective, distance learning is effective and easy to manage in daily life, and as the literature confirms [25], it can be a sound tool to guarantee, at the same time, standardized learning for all residents, with the possibility of reaching all regions of the country in a capillary manner, regardless of their actual organization.

Regarding theoretical topics, residents found the management of pharmacological therapy, the organization of the PPC model, and symptom management in PPC to be the most challenging. They also expressed the desire to learn more about PM and complex communication skills. In the open section of the survey, there were many positive comments and requests for further information, especially about pharmacological therapy, and learning courses with practical application of the content proposed in the online modules.

Despite its strengths, the program highlighted the challenges of relying solely on distance learning for developing practical competencies. While residents

expressed high levels of satisfaction and recognized the relevance of the topics covered, the absence of hands-on training limited their preparation for real-world application. Additionally, uneven participation and regional variability in PPC infrastructure underscore the need for supplementary, practice-based learning opportunities.

The implementation of a hands-on training experiences in which residents can handle patients in various healthcare settings (home, hospital, pediatric hospice) to complement these distance learning modes is now underway. The establishment of this model represents a significant step toward bridging the educational gap in PPC and PM within Italian pediatric residency programs. This program is consistent with global recommendations for improved PPC training to meet the increasing needs of children with life-limiting and life-threatening diseases. One of the main strengths lies in the multimodal delivery of our program, which incorporates asynchronous and synchronous online modules to provide accessible, flexible learning. This approach ensures that foundational topics, such as symptom management and pharmacological therapy, are uniformly taught across regions, compensating for the uneven availability of PPC services in Italy. The inclusion of clinical case-based learning fosters critical thinking and bridges the gap between theoretical knowledge and practical application. However, residents expressed a need for more hands-on experiences, reflecting the importance of complementing distance learning with supervised patient care. The substantial improvement in post-module test scores—from 22.5% to 90.4% correct answers—validates the program's effectiveness in enhancing theoretical knowledge. Yet, certain areas, such as defining PPC models and eligibility criteria, remain challenging for residents, suggesting a need for more targeted interventions in these domains.

It has been highlighted the importance of a multimodal approach in medical education, demonstrating that methods combining theoretical lectures, simulations, and clinical case discussions significantly improve residents' competencies [26]. This evidence supports the adoption of our model, which resulted in a substantial increase in theoretical knowledge. However, it remains essential to integrate practical experiences—such as clinical simulations and supervised internships—to consolidate learning and prepare residents for real-world challenges.

This study underscores the urgency of embedding PPC and PM into standardized residency curricula, a move supported by both the Italian legislative framework and international guidelines. Future studies should also explore the long-term impact of this educational approach by incorporating additional perspectives from researchers and field professionals.

Limitations of the study

Incomplete demographic information about participants prevents a comprehensive analysis of variations in engagement and performance across different residency programs. This limitation restricts the ability to tailor future interventions to specific groups or regions. One of our largest implementation issues was variable resident engagement in educational sessions. However, it is remarkable that residents still feel growth in their PC abilities despite incomplete attendance.

The absence of practical or clinical components, such as supervised patient care or simulations, limits the curriculum's ability to prepare residents for hands-on challenges in PPC and PM. While the program was valuable for foundational knowledge, practical training is essential for skill development.

Some new indicators should be taken into consideration, such as local consumption of analgesic drugs in pediatric patients with pain, the number of new patients referred to each regional center, and how many young pediatricians over time will decide to undertake their training in the fields of PM and PPC.

Conclusion

This Education initiative represents a major step forward in addressing the critical need for standardized training in PPC and PM within Italian residency programs. By reaching 70% of pediatric residents nationwide, the program demonstrated feasibility, accessibility, and effectiveness in improving foundational knowledge. The significant increase in post-test scores (from 22.5% to 90.4%) confirms its impact. The structured online modules, focusing on key clinical topics, resulted in substantial improvements in participants' theoretical understanding. As PPC gains recognition as a critical component of pediatric care, this model provides a promising framework for expanding and standardizing PPC and PM education across Italy. Moving forward, integrating hands-on clinical experiences and structured internships will be essential to complement theoretical learning. Future studies should focus on enhancing engagement and evaluating the long-term impact of this training on clinical practice and patient outcomes.

Abbreviations

PM	Pain Management
PPC	Pediatric Palliative Care
IRSP	Italian School of Residency in Pediatrics
PR	Pediatric Residents
ECTS	European Credit Transfer and Accumulation System
LLC	Life-Limiting Conditions
LTC	Life-Threatening Conditions
ONSP	Italian National Association of Pediatric Residents ("Osservatorio Nazionale Specializzandi in Pediatria")
SC	Steering Committee
MUR	Ministero dell'Università e della Ricerca

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s13052-025-01963-3.

Supplementary Material 1.

Supplementary Material 2.

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Authors' contributions
FB conceptualized the design of the work; LDZ, SA, EB, MB, IC, MJ, LM, MS, AZ, and AC drafted the manuscript; AC, EB, GM, EB critically revised it. All authors read and approved the final manuscript.

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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author (FB) upon reasonable request.

Declarations

Ethics approval and consent to participate
Not required.

Consent for publication
Not required.

Competing interests
The authors declare that they have no competing interests.

Author details
[1]Department of Women's and Children's Health, Pediatric Palliative Care, Pain Service, University Hospital of Padova, Via Giustiniani, 3, Padua 35128, Italy. [2]Pain and Pediatric Palliative Care Service, Institute for Maternal and Child Health, IRCCS "Burlo Garofolo", Trieste, Italy. [3]Pediatric Palliative Care Service, Fondazione Hospice MT. C. Seràgnoli, Bentivoglio, Bologna, Italy. [4]Pediatric Pulmonology Unit, Regina Margherita Children Hospital, AOU Città Della Salute E Della Scienza, Turin, Italy. [5]Pediatric Palliative Care Service, Azienda Provinciale Per I Servizi Sanitari (APSS), Trento, Italy. [6]Hospice and Palliative Care Unit, Casa Sollievo Bimbi, Associazione VIDAS, Milan, Italy. [7]Department of Pediatrics, University Milano-Bicocca/Foundation MBBM, Monza, Italy. [8]Pediatric Pain and Palliative Care Service, IRCCS Istituto Giannina Gaslini, Genoa, Italy. [9]Center for Pediatric Palliative Care, Bambino Gesù Children Hospital IRCCS, Rome, Italy. [10]University of Milan, Milan, Italy. [11]Department of Medicine, Surgery and Health Sciences, University of Trieste, Trieste, Italy. [12]Department of Pediatrics, Institute for Maternal and Child Health IRCCS "Burlo Garofolo", Trieste, Italy. [13]Department of Clinical, Surgical, Diagnostic and Pediatric Sciences, Pediatric Unit, University of Pavia, Pavia, Italy. [14]Pediatric Clinic, Fondazione IRCCS Policlinico San Matteo, Pavia, Italy. [15]Department of Women's and Children's Health, Neonatal Intensive Care Unit, University Hospital of Padova, Padua, Italy.

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References

1. Connor SR, Downing J, Marston J. Estimating the Global Need for Palliative Care for Children: A Cross-sectional Analysis. J Pain Symptom Manage. 2017;53:171–7.
2. Benini F, Mercante A, Di Nunzio S, Papa S, PalliPed working group. A Nationwide Study to Evaluate Accessibility to Specialized Pediatric Palliative Care in Italy-Patients, Needs, and Critical Issues: The PalliPed Study. J Palliat Med. 2024;27:1346–53.
3. Mack JW, Wolfe J. Early integration of pediatric palliative care: for some children, palliative care starts at diagnosis. Curr Opin Pediatr. 2006;18:10–4.
4. 2022. Available from: https://icpcn.org/about-icpcn/. Cited 2025 Feb 26.
5. Bergstraesser E. Pediatric palliative care-when quality of life becomes the main focus of treatment. Eur J Pediatr. 2013;172:139–50.
6. American Academy of Pediatrics. Committee on Bioethics and Committee on Hospital Care Palliative care for children. Pediatrics. 2000;106:351–7.
7. Benini F, Mercante A, Di Nunzio S, Papa S, Agosto C, Albanesi B, et al. The specialized pediatric palliative care service in Italy: how is it working? Results of the nationwide PalliPed study. Ital J Pediatr. 2024;50:55.
8. Kolarik RC, Walker G, Arnold RM. Pediatric resident education in palliative care: a needs assessment. Pediatrics. 2006;117:1949–54.
9. Rusalen F, Ferrante A, Pò C, Salata M, Agosto C, Benini F. Pain therapy, pediatric palliative care and end-of-life care: training, experience, and reactions of pediatric residents in Italy. Eur J Pediatr. 2014;173:1201–7.
10. Fiuza M, Silva JG. Listening to the Residents: The Perception of Pediatric Palliative Care Education in a Residency Program in Brazil. Am J Hosp Palliat Care. 2023;40:1067–73.
11. Mohanti BK, Bansal M, Gairola M, Sharma D. Palliative care education and training during residency: a survey among residents at a tertiary care hospital. Natl Med J India. 2001;14:102–4.
12. Lefeubvre C, Viallard M-L. Schell M [Pediatric palliative care: a national survey of French pediatric residents' knowledge, education, and clinical experience]. Arch Pediatr Organe Off Soc Francaise Pediatr. 2014;21:834–44.
13. Meric R, Stone RG, Lupu VV, Lomholt S, Slobođanac M, Maár BA, et al. The Diversity of Pediatric Residency Programs across Europe: Admission Procedures, Curricula and Duration of Courses. J Pediatr. 2020;222:266-268.e1.
14. Corsello A, Rotulo S, Santangelo A, Diana A, Rossi F, Antonietta Catania M, et al. Challenges and opportunities in pediatric residency: an analysis of the increasing number of residents in Italy. Ital J Pediatr. 2024;50:206.
15. Gula AL, Merkel E, Bouchelle Z, Nelin T, Rojas CR, Hwang J, et al. Primary Palliative Care for Pediatric Residents: A Curricular Framework and Pilot. Acad Pediatr. 2023;23:1133–7.
16. Sullivan AM, Lakoma MD, Billings JA, Peters AS, Block SD, PCEP Core Faculty. Teaching and learning end-of-life care: evaluation of a faculty development program in palliative care. Acad Med J Assoc Am Med Coll. 2005;80:657–68.
17. Paulsen K, Wu DS, Mehta AK. Primary Palliative Care Education for Trainees in U.S. Medical Residencies and Fellowships: A Scoping Review. J Palliat Med. 2021;24:354–75.
18. Palliative Care for Children & Young People - (CYP) EAPC. EAPC. Available from: https://eapcnet.eu/eapc-groups/reference/children-young-people/. Cited 2025 Feb 26.
19. Benini F, Cauzzo C, Congedi S, Da Dalt L, Cogo P, Biscaglia L, et al. Training in pediatric palliative care in Italy: still much to do. Ann Ist Super Sanita. 2019;55:240–5.
20. Gazzetta Ufficiale. Available from: https://www.gazzettaufficiale.it/gazzetta/serie_generale/caricaDettaglio?dataPubblicazioneGazzetta=2010-03-19&numeroGazzetta=65. Cited 2025 Feb 26.
21. Benini F, Bellentani M, Reali L, Lazzarin P, De Zen L, Pellegatta F, et al. An estimation of the number of children requiring pediatric palliative care in Italy. Ital J Pediatr. 2021;47:4.
22. Romanos-Sirakis E, Demissie S, Fornari A. Implementation of a Multi-Modal Palliative Care Curriculum for Pediatric Residents. Am J Hosp Palliat Care. 2021;38:1322–8.
23. Barnett MD, Maurer SH, Wood GJ. Pediatric Palliative Care Pilot Curriculum: Impact of "Pain Cards" on Resident Education. Am J Hosp Palliat Care. 2016;33:829–33.
24. Yazdani S, Evan E, Roubinov D, Chung PJ, Zeltzer L. A longitudinal method of teaching pediatric palliative care to interns: preliminary findings regarding changes in interns' comfort level. Palliat Support Care. 2010;8:35–40.

25. Cornio AR, Sciurpa E, Priano W, Genovese D, Cerri A, Troia A, et al. Distance learning in primary health care: an Italian experience among medical residents to integrate public health and primary health care. Recenti Prog Med. 2024;115:195–8.
26. Elendu C, Amaechi DC, Okatta AU, Amaechi EC, Elendu TC, Ezeh CP, et al. The impact of simulation-based training in medical education: A review. Medicine (Baltimore). 2024;103:e38813.

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